

Lesson 1.1

**FUNCTION FAMILIES
AND TRANSFORMATIONS**

Your Name

Mrs. Theo

/ /

Notes

Math Skill Objective: To be able to identify the parent function given a function. To be able to describe transformations of functions. To be able to graph linear, quadratic, and absolute value functions using a table.

[HSF.BF.B.3](#)

Life Lessons: Knowing the context and background information of something is really helpful to understanding it and not being intimidated by it. Lots of things have patterns and when a pattern is found and clarified, you can make useful predictions.

Let's Play with Function Transformations and figure out what a , b , h , and k do!

$$f(x) = a \cdot f(bx - h) + k$$

To explore the affects on Quadratic, Absolute Value, Cubic, Square Root functions

<https://www.geogebra.org/m/uTddJKRC#material/HJvZSUna>

To explore the affects on Logarithmic functions

<https://www.desmos.com/calculator>

$$\frac{1}{2} \div 2 = \frac{1}{4}$$

$$\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$$

$$2^3 = 2 \cdot 2 \cdot 2 = 8$$

$$2^2 = 2 \cdot 2 = 4$$

$$2^1 = 2$$

$$2^0 = 1$$

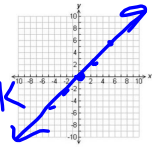
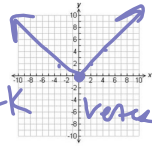
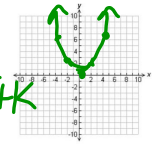
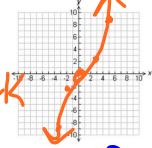
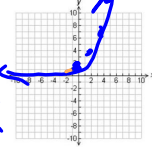
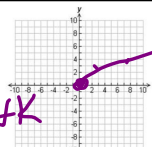
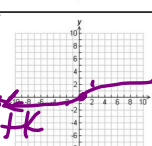
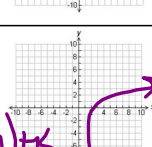
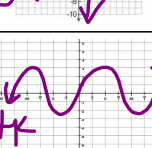
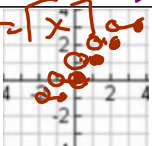
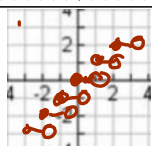
$$2^{-1} = \frac{1}{2}$$

$$2^{-2} = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$$

$$2^{-3} = \frac{1}{8}$$

+1 ↗
 -1 ↘
 -1 ↘

↗ x2 ↘
 ↗ x2 ↘
 ↗ :2 ↘
 ↗ :2 ↘
 ↗ :2 ↘
 ↗ :2 ↘

Function	Parent Function	Graph	Table	Effects of Parameter a	Effects of Parameter h	Effects of Parameter k
D: $(-\infty, \infty)$ R: $(-\infty, \infty)$ Linear $y = x$ $y = a(x-h) + k$			x -2 -1 0 1 2 y -2 -1 0 1 2 (Handwritten: +1, +1)	$y = 3x$	$y = (x+4)$	$y = x + 6$
D: $(-\infty, \infty)$ R: $[0, \infty)$ Absolute Value $y = x $ $y = a x-h + k$ V shape			x -2 -1 0 1 2 y 2 1 0 1 2 (Handwritten: vertex)	$y = 0.5 x $	$y = x+4 $	$y = x + 6$
D: $(-\infty, \infty)$ R: $[0, \infty)$ Quadratic $y = x^2$ $y = a(x-h)^2 + k$ U shape			x -2 -1 0 1 2 y 4 1 0 1 4 (Handwritten: vertex)	$y = 0.5x^2$	$y = (x - 3)^2$	$y = x^2 - 3$
D: $(-\infty, \infty)$ R: $(-\infty, \infty)$ Cubic $y = x^3$ $y = a(x-h)^3 + k$ S shape			x -2 -1 0 1 2 y -8 -1 0 1 8 (Handwritten: center)	$y = 3x^3$	$y = (x+3)^3$	$y = x^3 + 3$
X is the Exponential $y = b^x$ $y = a \cdot b^{x-h} + k$			$y = 2^x$ x -1 0 1 2 3 y 1/2 1 2 4 8	$y = -1(3)^x$	$y = 3^{x-1}$	$y = 3^x - 1$
D: $[0, \infty)$ Square Root $y = \sqrt{x}$ $y = a\sqrt{x-h} + k$			x -1 0 1 4 9 y 0 1 2 3	$y = \sqrt{-1x}$	$y = \sqrt{x - .2}$	$y = \sqrt{x} - .2$
D: $(-\infty, \infty)$ R: $(-\infty, \infty)$ Cubic Root $y = \sqrt[3]{x}$ $y = a\sqrt[3]{x-h} + k$			x 1 0 1 8 27 y -1 0 1 2 3	$y = -\sqrt[3]{x}$	$y = \sqrt[3]{x + 7}$	$y = \sqrt[3]{x} + 7$
D: $(0, \infty)$ R: $(-\infty, \infty)$ Logarithmic $y = \log x$ $y = a \log(x-h) + k$			x y	$y = -4 \log(x)$	$y = \log(x - 4)$	$y = \log x - 4$
Periodic (Sine) $y = \sin(x)$ $y = a \sin(x-h) + k$			x y	$y = 6 \sin(x)$	$y = \sin(x+3\pi)$	$y = \sin(x) + 4.5$
Step Function D: $(-\infty, \infty)$ R: $\{y \in \mathbb{Z} \mid -\infty < y < \infty\}$		 	$y = \lceil x \rceil$ x -1.5 -0.5 0.5 1.5 2.5 y -1 0 1 2 3 $y = \lfloor x \rfloor$ x -1.5 -0.5 0.5 1.5 2.5 y -2 -1 0 1 2	$y = \lceil x \rceil$ Ceiling Function Greatest Integer	$y = \lfloor x \rfloor$ Floor Function Least Integer	

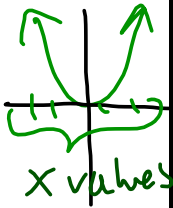
Function	Parent Function	Graph	Table	Effects of Parameter a	Effects of Parameter h	Effects of Parameter k
Linear D: $(-\infty, \infty)$ R: $(-\infty, \infty)$	$y = x$ $y = ax + k$		$\begin{array}{c cccc} x & -2 & -1 & 0 & 1 & 2 \\ \hline y & -2 & -1 & 0 & 1 & 2 \end{array}$	$y = 3x$	$y = (x+4)$	$y = x + 6$
Absolute Value D: $(-\infty, \infty)$ R: $[0, \infty)$	$y = x $ $y = a x-h + k$		vertex $\begin{array}{c cccc} x & -2 & -1 & 0 & 1 & 2 \\ \hline y & 2 & 1 & 0 & 1 & 2 \end{array}$	$y = 0.5 x $ Vertical shrink by a factor of .5	$y = x+4 $ Horiz shift left 4	$y = x + 6$ Vert. shift up 6
Quadratic D: $(-\infty, \infty)$ R: $[0, \infty)$	$y = x^2$ $y = a(x-h)^2 + k$		vertex $\begin{array}{c cccc} x & -2 & -1 & 0 & 1 & 2 \\ \hline y & 4 & 1 & 0 & 1 & 4 \end{array}$	$y = 0.5x^2$ Vert. Shrink by 1/2	$y = (x-3)^2$ Horiz. shift right 3	$y = x^2 - 3$ Vert. shift down 3
Cubic D: $(-\infty, \infty)$ R: $(-\infty, \infty)$	$y = x^3$ $y = a(x-h)^3 + k$		center $\begin{array}{c cccc} x & -2 & -1 & 0 & 1 & 2 \\ \hline y & -8 & -1 & 0 & 1 & 8 \end{array}$	$y = 3x^3$ Vert. Stretch by 3	$y = (x+3)^3$ Horiz. shift left 3	$y = x^3 + 3$ Vert. shift up 3
Exponential D: $(-\infty, \infty)$ R: $(0, \infty)$	$y = b^x$ $y = ab^{x-h} + k$		$y = 2^x$ $\begin{array}{c cccc} x & -1 & 0 & 1 & 2 & 3 \\ \hline y & \frac{1}{2} & 1 & 2 & 4 & 8 \end{array}$	$y = -1(3)^x$	$y = 3^{x-1}$	$y = 3^x - 1$
Square Root D: $[0, \infty)$ R: $[0, \infty)$	$y = \sqrt{x}$ $y = a\sqrt{x-h} + k$		$\begin{array}{c cccc} x & -1 & 0 & 1 & 4 & 9 \\ \hline y & i & 0 & 1 & 2 & 3 \end{array}$	$y = \sqrt{-1x}$	$y = \sqrt{x - .2}$	$y = \sqrt{x} - .2$
Logarithmic D: $(0, \infty)$ R: $(-\infty, \infty)$	$y = \log x$ $y = a \log(x-h) + k$			$y = -4 \log(x)$	$y = \log(x - 4)$	$y = \log x - 4$
Periodic (Sine) D: $(-\infty, \infty)$ R: $[-1, 1]$	$y = \sin x$			$y = 6 \sin(x)$	$y = \sin(x+3\pi)$	$y = \sin(x)+4.5$
Step Function D: $(-\infty, \infty)$ R: $y \in \mathbb{Z}$	$y = \lceil x \rceil$ $y = \lfloor x \rfloor$		$\begin{array}{c cccc} x & 1.5 & 0.5 & 1.2 & 3.7 \\ \hline y & 1 & 0 & 1 & 2 & 4 \end{array}$ $\begin{array}{c cccc} x & 1.5 & 0.5 & 1.2 & 3.7 \\ \hline y & 1 & 0 & 0 & 1 & 3 \end{array}$	$y = \lceil x \rceil$	Ceiling Function	Greatest Integer
				$y = \lfloor x \rfloor$	Floor Function	Least Integer

Level 1

Domain

All the possible x values that can exist in points for the function.

ex. $f(x) = x^2$



Verbally
All Real Numbers
 \mathbb{R}

Bracket

$D: (-\infty, \infty)$

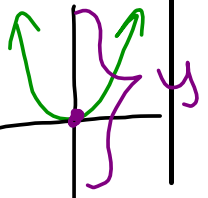
Define your variable, "such that" Describable
Interval Notation

$\{x \in \mathbb{R} \mid -\infty < x < \infty\}$
"in the set of"

Range

All the possible y values that can exist in points for the function.

ex. $f(x) = x^2$



Verbally
All Positive \mathbb{R} numbers ≥ 0

Bracket

$R: [0, \infty)$

Interval Notation

$\{y \in \mathbb{R} \mid 0 \leq y < \infty\}$

